7th Grade, Life Science, Genetic Engineering

To what extent and for what purpose should we genetically engineer organisms?

Unit Developed by
Soona Schmidt
Sacajawea Junior High
Lewiston School District
Lewiston, Idaho

The Core Teacher Program
A program of the Idaho Coaching Network
Idaho Department of Education
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

**Universal Design for Learning (UDL)**

<table>
<thead>
<tr>
<th>Multiple Means of Representation</th>
<th>Provide options for language, mathematical expressions, and symbols</th>
<th>Provide options for comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Offer ways of customizing the display of information</td>
<td>✓ Clarify vocabulary and symbols</td>
<td>✓ Activate or supply background knowledge</td>
</tr>
<tr>
<td>✓ Offer alternatives for auditory information</td>
<td>❏ Clarify syntax and structure</td>
<td>✓ Highlight patterns, critical features, big ideas; and relationships</td>
</tr>
<tr>
<td>✓ Offer alternatives for auditory information</td>
<td>✓ Support decoding text, mathematical notation, and symbols</td>
<td>❏ Guide information processing, visualization and manipulation</td>
</tr>
<tr>
<td></td>
<td>❏ Promote understanding across languages</td>
<td>✓ Maximize transfer and generalization</td>
</tr>
<tr>
<td></td>
<td>✓ Illustrate through multiple media</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple Means of Action and Expression</th>
<th>Provide options for expression and communication</th>
<th>Provide options for executive functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Vary the methods for response and navigation</td>
<td>✓ Use multiple media for communication</td>
<td>❏ Guide appropriate goal-setting</td>
</tr>
<tr>
<td>✓ Optimize access to tools and assistive technologies.</td>
<td>✓ Use multiple tools for construction and composition</td>
<td>❏ Support planning and strategy development</td>
</tr>
<tr>
<td></td>
<td>✓ Build fluencies with graduated levels of support for practice and performance</td>
<td>✓ Facilitate managing information and resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Enhance capacity for monitoring progress</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple Means of Engagement</th>
<th>Provide options for sustaining effort and persistence</th>
<th>Provide options for self-regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Optimize</td>
<td>✓ Heighten salience</td>
<td>✓ Promote expectations and beliefs that</td>
</tr>
</tbody>
</table>

Original unit development sponsored by The Idaho Coaching Network
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

- Individual choice and autonomy
  - Optimize relevance, value, and authenticity
  - Minimize threats and distractions

- Optimize relevance, value, and authenticity
  - Vary demands and resources to optimize challenge
  - Foster collaboration and communication
  - Increase mastery-oriented feedback

- Optimize motivation
  - Facilitate personal coping skills and strategies
  - Develop self-assessment and reflection

Original unit development sponsored by The Idaho Coaching Network
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

Webb's Depth of Knowledge - Level 1 (Recall)

- Who, What, When, Where, Why
- Define
- Identify
- Illustrate
- Label
- List
- Match
- Measure
- Recite
- Recognize
- Report
- Use

Webb's Depth of Knowledge - Level 2 (Skill/Concept)

- Categorize
- Classify
- Collect and Display
- Compare
- Construct
- Estimate
- Graph
- Identify Patterns
- Infer
- Interpret
- Observe
- Organize
- Predict
- Summarize

Webb's Depth of Knowledge - Level 3 (Strategic Thinking)

- Assess
- Construct
- Critique
- Develop a Logical Argument
- Differentiate
- Draw Conclusions
- Explain Phenomena in Terms of Concepts
- Formulate
- Hypothesize
- Investigate
- Revise
- Use Concepts to Solve Non-Routine Problems

Original unit development sponsored by The Idaho Coaching Network
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

Webb's Depth of Knowledge - Level 4 (Extended Thinking)

✓ Analyze
✓ Apply Concepts
✓ Create
✓ Critique
✓ Synthesize
❏ Prove
❏ Connect
✓ Design

Idaho Coaching Network Unit Plan Template

Unit Title: Genetic Engineering: To what extent and for what purpose should we modify organisms?

Created By: Soona Schmidt

Subject: Life Science

Grade: 7th

Estimated Length (days or weeks): 2 weeks (10, 47 minute classes)

Unit Overview (including instructional context):

In this unit on genetic engineering, students will critically read and watch a variety of texts and videos that describe different real world examples of genetic engineering. Then students will analyze the benefits and drawbacks of a real world example of genetic manipulation of their choice, using evidence from the texts. Students will assess the credibility and accuracy of sources. Students will take what they have learned about genetic engineering and transfer that information into an analysis about when and for what purpose genetic engineering is acceptable. This analysis must be based on specific textual evidence. They will share their stance and evidence in a clear manner (presentation, PSA, poster, informational video, etc.)

Students will also understand that differing opinions are ok as long as they are informed and based on evidence.

Before this genetic engineering unit, students will learn about genetics, how traits get passed on from parent to offspring. After learning about genetic engineering and gene therapy students will learn about evolution, how a species changes over time. Evolution can be driven by the environment and/or humans. Humans influencing the genetics of species (genetic engineering, artificial selection) has an effect on the evolution of
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

Unit Rationale (including Key Shift(s)):
Key Shift One: Students will build knowledge and academic language through a balance of content rich, complex nonfiction and literary texts. Genetic engineering is a rapidly changing field in current science. There is a lot of information about genetic manipulation available from many different complex texts including news articles, websites and informational videos. Many informed people disagree about how to move forward with genetic engineering biotechnology. This unit will provide students with the opportunity to explore a multitude of resources about genetic engineering. Then students will analyze a real-world example of genetic engineering by evaluating its benefits and drawbacks. The goal is for students to become comfortable exploring a variety of resources (texts) and collecting evidence from the texts to analyze a real-world example of genetic manipulation.

Essential Question:
● To what extent and for what purpose should humans genetically modify organisms?

Enduring Understanding:
● Students should be able to develop an informed scientific opinion based on a wide range of accurate scientific information.

<table>
<thead>
<tr>
<th>Measurable Outcomes: Learning Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Students will cite specific textual evidence to support their analysis of genetic engineering.</td>
</tr>
<tr>
<td>● Students will gather and synthesize information about how humans influence the inheritance of desired traits in organisms.</td>
</tr>
<tr>
<td>● Students will gather relevant, credible and accurate information from multiple sources.</td>
</tr>
</tbody>
</table>

Success Criteria (Evidence):
● Students can cite textual evidence to support their analysis of genetic engineering.
● Students can find and use information about genetic engineering.
● Students can gather information from multiple sources that is relevant, credible and accurate.

Targeted Standards:
Idaho English Language Arts/Literacy Standards:
● RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Targeted Standards:
Content Standards:
● MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Targeted Standards:
Standards for Mathematical Practice (if applicable):
●
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

<table>
<thead>
<tr>
<th>Supporting Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>● WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.</td>
</tr>
<tr>
<td>● SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summative Assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Summative Assessment Description: Students will create a product (poster, presentation, video, write a paper, make a print advertisement, etc.) that describes a real world example of genetic engineering. Using multiple relevant, credible, and accurate sources, students will analyze the benefits and drawbacks of using this type of genetic manipulation.</td>
</tr>
<tr>
<td>● Depth of Knowledge (DOK) Explanation: The summative assessment for this unit has a Depth of Knowledge Level 3. In the student’s final project they must cite specific text evidence, compare information across texts and draw conclusions from the texts. All of these skills have are DOK Level 3, which also matches the DOK of the targeted standards where students are supposed to gather and cite textual evidence from multiple credible and accurate sources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Text(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Issue Overview: Gene Editing, By: John Laureman (Adapted by Newsela Staff)</td>
</tr>
<tr>
<td>● Issue Overview: Gene editing</td>
</tr>
</tbody>
</table>
Supplemental materials/resources:
This is a list of supplemental resources that outline real world examples of genetic engineering and/or give an overview of the topic. The students can choose which articles/examples to explore more based on what interest them the most.

Newsela articles
With Newsela articles, the students can modify the lexile level of the text to best suit their reading level. Or the teacher can print different versions of the same article and give the appropriate lexile level to each student.

- Frankenskeeters to seek mosquito brides to curb dengue disease
- Passenger pigeons are extinct, but scientists hope to bring them back
- Chinese company edits pig DNA, develops piglets that will stay pet-sized
- Opinion: New technology spurs debate about when to "edit" human genes
- Opinion: We can – and should – engineer a better baby but set limits
- Gene-editing kit stirs up worry over do-it-yourself DNA creations
- From farm to lab to table, a tale of tomatoes and a top banana
- 20 years since the first sheep was cloned — are we ready for humans?
- Issue Overview: GMOs and engineered food

YouTube videos
- https://www.youtube.com/watch?v=2pp17E4E-O8 Genome Editing with CRISPR-Cas9
- https://www.youtube.com/watch?v=jAhjPd4uNFY Genetic Engineering Will Change Everything Forever – CRISPR
- https://www.youtube.com/watch?v=TnzcwTyr6cE How To Eradicate One Of Our Deadliest Enemies – Gene Drive & Malaria
- https://www.youtube.com/watch?v=e0NT9i4Qnak What If We Killed All the Mosquitoes?
- https://www.youtube.com/watch?v=UfA_jAKV29g CRISPR: A Gene-Editing Superpower
- https://www.youtube.com/watch?v=sH4bi60alZU Why are GMOs Bad?
- https://www.youtube.com/watch?v=y-0mT4oQH3o Resurrection Biology: How to Bring Animals Back From Extinction

Text Complexity Analysis:

Text Complexity Analysis of: Issue Overview: Gene Editing
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

by Author: John Laureman (Adapted by Newsela staff)
Text Type (fiction, informational etc.): Informational

Text Description
In the article Issue Overview: Gene Editing, the author states that humans have been manipulating genetics for thousands of years and then identifies the recent invention of Crispr-Cas9 (Crispr) technology and claims that this technology will greatly change genetic engineering in our world. Next, the article outlines some of the ways scientists are experimenting with Crispr technology and the possible outcomes. The author then provides a brief description of how Crispr works. Finally, the author mentions the opposing views on using Crispr on humans.

What is your final recommendation based on quantitative, qualitative, and reader-task considerations? Why?
This article is very complex to moderately complex for 6-8 grade students based on the reader’s background knowledge of genetics and genetic engineering. Students with strong background knowledge of genetics and heredity should find this article moderately complex. Because the text is very complex and the background knowledge demands are high, the students will need educational supports to be successful interacting with this text. However, it will guide students’ exploration of the essential questions: To what extent and for what purpose should humans genetically modify organisms?

Mark all that apply:
Grade Level Band: K-5 □ 6-8 ✓ 9-12 ✓ PD □

Content Area: English/Language Arts (ELA) □ Foreign Language (FL) □ General (G) □ Health, Physical Education (HPE) □
History/Social Studies (HSS) □ Humanities (H) □ Math (M) □
Professional Development (PD) □ Professional/Technical Education (PTE) □
Science (S) ✓

Quantitative Measure
Quantitative Measure of the Text: 1050L
Range: 955-1155
Associated Grade Band Level: 6-8

Qualitative Measures
Text Structure (story structure or form of piece): This text is moderately complex in its structure because the connections between the Crispr technology and its applications are implicit and the order of the article is logical and sequential. The text features and graphics enhance the reader's understanding.

Original unit development sponsored by The Idaho Coaching Network
### Considerations for Reader and Task

**Possible Major Instructional Areas of Focus (include 3-4 CCS Standards) for this Text:**

1. **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. **WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
3. **SL.8.4** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Students will be using this text as well as a few supporting texts to explain a real-world use of genetic engineering and explain the benefits and drawbacks of using this type of genetic manipulation. Students will focus on citing textual evidence from multiple relevant sources and then coherently presenting their findings.

**Potential Challenges this Text Poses:**

1. Students have limited background knowledge of this content.
2. The science specific language demands are very high.
3. There are multiple lenses students can view the issue of genetic engineering through. This might prove challenging to students because there is no one right answer.

**Differentiation/Supports for Students:**

1. Before beginning to work with the text, students will be introduced to vocab that might be challenging.
2. There will be multiple versions of this text available at different lexile levels to support and/or challenge the student.
3. Use multiple texts with different perspectives and different real-world examples of genetic engineering to support students with different reading levels and interests.

---

**Scaffolds and Extensions**

<table>
<thead>
<tr>
<th>UDL Components:</th>
<th>Support for students who are ELL, have disabilities or read well below</th>
<th>Extensions for advanced students:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Original unit development sponsored by The Idaho Coaching Network
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

grade level text band:

- Multiple ways to access the information including reading, watching videos and animations, whole class discussion, and think-pair-share
- Students choose the real-world example of genetic engineering they want to explore more
- Students choose how they want to present the benefits and drawbacks of a specific example of genetic engineering

- Watch videos/animations that give an overview of genetic engineering.
- Provide digital copies of the articles that allow students to select the appropriate lexile level, define words and have the text spoken aloud.

- Provide access to articles that have a more advanced lexile level
- Students can choose how deeply they want to explore their real world example of genetic engineering
- Students can choose how much detail to include in presenting their knowledge

Vocabulary

Targeted Academic Vocabulary
- Engineer
- Manipulate
- Inherited
- Trait

Targeted Content Area Vocabulary
- GMO
- CRISPR
- Gene
- Gene-editing
- Germ-line
- Genetics
- Genetic manipulation
- Genetic engineering
- Vector
- Biotechnology
- Gene therapy

Instructional Sequence

Original unit development sponsored by The Idaho Coaching Network
Major Idea/Topic #1: What is genetic engineering?

<table>
<thead>
<tr>
<th>Day(s) and Desired Outcome(s)</th>
<th>Texts and Resources</th>
<th>Instructional Notes (including Scaffolding, Extensions, Vocabulary Terms and strategies, UDL Principles, and Formative Assessments)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><strong>3</strong></em>:</td>
<td>Pic Collage of genetically engineered organisms (Appendix 12)</td>
<td>Teacher shows a Pic Collage of genetically modified organisms and asks students what all the organisms have in common. The teacher informs the students that all the organisms shown are genetically engineered and shows the second Pic Collage with the names of all the organisms on it. The teacher informs the class that they will be learning about genetic manipulation and trying to answer the essential question: To what extent and for what purpose should humans genetically modify organisms?</td>
</tr>
<tr>
<td>Desired Outcome(s):</td>
<td>Genetic Engineering Vocab Graphic Organizer (Appendix 4)</td>
<td>On Day 1, the teacher will guide students through the first two CODE vocabulary strategies using the Genetic Engineering Vocab Graphic Organizer to help students learn the following words: engineer, manipulate, GMO, CRISPR, inherited, trait.</td>
</tr>
<tr>
<td>Students will explain how and for what purposes organisms are genetically modified.</td>
<td>Life Science (Updated 2016) iBook</td>
<td>Connect--See it, say it, show it, store it: Students will look at the written vocabulary word, then we will pronounce it slowly together. Next, students will write the word out and write a definition for the word in their own words.</td>
</tr>
<tr>
<td>Students will correctly use vocabulary about genetic engineering.</td>
<td>YouTube Videos: How Cloning Can Extend Your Lifespan <a href="https://www.yout">https://www.yout</a></td>
<td>Organize--Concept map: Students will create a concept map to visually represent how the 5 targeted vocabulary words are related to each other. On Day 2, the teacher will guide students through the third CODE vocabulary strategy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deep Process--Three-way tie: Students will choose three of the vocabulary words and arrange them into a triangle shape with lines between the words. On the lines, students will explain the relationships between the connected words. On Day 3, the teacher will guide students through the last CODE vocabulary strategy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exercise--Three’s a crowd: Students decide which word in a group of three doesn’t belong and then explain why.</td>
</tr>
</tbody>
</table>
Students read/listen to the selected chapters from the Life Science (Updated 2016) iBook and watch the selected YouTube videos to answer the text-based questions on the note-catcher (MS-LS4-5). This activity is expected to span several days and students work at their own pace. As students complete the reading, videos and text-based questions, they move to a designated section of the room and wait for a small group of students (4-5 maximum) who are all done. Students will have a small group discussion/peer conference about the resources and the questions from the TBQs note-catcher. The goal of the peer conference is for each student in the group to reach at least 80% understanding of the material. Students will self-identify their understanding level. When all students in the group have reached 80% understanding, they call the teacher over for a teacher conference. The teacher asks all the students in the group different questions about the content to check their understanding and clear up any misconceptions (formative assessment). The goal of the teacher conference it for all students to reach at least a 95% understanding of the content.
Major Idea/Topic #2: Issue Overview: Gene Editing

<table>
<thead>
<tr>
<th>Day(s) and Desired Outcome(s)</th>
<th>Texts and Resources</th>
<th>Instructional Notes (including Scaffolding, Extensions, Vocabulary Terms and strategies, UDL Principles, and Formative Assessments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day(s) <strong><strong>2</strong></strong>: Desired Outcome(s): Students will accurately summarize genetic modification and different perspectives on the ethics of</td>
<td>Issue Overview: Gene Editing, By: John Laureman (Adapted by Newsela Staff) (Appendix 5)</td>
<td>The teacher will read the article <em>Issue Overview: Gene Editing</em> by John Laureman out loud to the class (MS-LS4-5). As the teacher is reading the article, students will be recording what they notice and wonder about the article. When the teacher is done reading, students will share out their notices and wonders with the whole class.</td>
</tr>
<tr>
<td></td>
<td>YouTube Video: Genome Editing with CRISPR-Cas9 <a href="https://www.youtube.com/watch?">https://www.youtube.com/watch?</a></td>
<td>The whole class will watch the YouTube video Genome Editing with CRISPR-Cas9. Students will discuss with a shoulder partner how CRISPR works and differing perspectives on how this biotechnology should be used (MS-LS4-5). Then students share their ideas with the class (formative assessment).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students will do a close reading of Issue Overview: Gene Editing and answer text dependent questions with their shoulder partner (MS-LS4-5, RST.6-8.1, WHST.6-8.8). Text Dependent Questions:</td>
</tr>
</tbody>
</table>
### Major Idea/Topic #3: Real world examples of genetic engineering (GMO foods and genetically engineered mosquitoes for disease control)

<table>
<thead>
<tr>
<th>Day(s) and Desired Outcome(s)</th>
<th>Texts and Resources</th>
<th>Instructional Notes (including Scaffolding, Extensions, Vocabulary Terms and strategies, UDL Principles, and Formative Assessments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day(s) <em><strong>1</strong></em>_:</td>
<td>GMO Foods Note-catcher (Appendix 6)</td>
<td>Students will review the meaning of GMO.</td>
</tr>
<tr>
<td>Desired Outcome(s): Students will accurately explain GMO foods and the benefits and drawbacks of them.</td>
<td>GMO Foods Newsela Articles Issue Overview: GMOs and engineered food From farm to lab to table, a tale of tomatoes and a top banana</td>
<td>The teacher will read the Newsela article Issue Overview: GMOs and engineered food to the whole class. Teacher will model summarizing GMO foods and the benefits and drawbacks described in this article. Together the class will take notes on the note-catcher as the teacher models how to do this. Students will read/listen to the Newsela article From farm to lab table, a tale of tomatoes and a top banana and read the newspaper article, Photosynthesis on Steroids by Seth Borenstein, 11/18/2016, and then watch the YouTube video titled Why are GMOs bad? As students explore these resources, they will work with a partner to summarize the type of genetic engineering described in the resource, and the benefits and drawbacks of this type of genetic engineering. Student will use the note-catcher provided to guide their learning.</td>
</tr>
<tr>
<td>Day(s) _<em><strong>1</strong></em>:</td>
<td>GE Mosquitoes Note-catcher (Appendix 7)</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Desired Outcome(s): Students will accurately explain how and why mosquitoes are being genetically modified and the benefits and drawbacks of using GMO foods (formative assessment).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE Mosquitoes Newsela Article Frankenskeeters to seek mosquitoes brides to curb dengue fever and watch the YouTube videos What If We Killed All the Mosquitoes? and How to Eradicate One of Our Deadliest Enemies-Gene Drive &amp; Malaria. As students explore the resources, they will write a brief summary, and explain the benefits and drawbacks discussed in each resource.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students will review the meaning of genetic engineering.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After exploring the resources, with a partner, students will write a summary of genetically modifying mosquitoes to help control disease and analyze the benefits and drawbacks of doing this (MS-LS4-5, RST.6-8.1, WHST.6-8.8).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iPads with internet access note taking (MS-LS4-5, RST.6-8.1, WHST.6-8.8).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students will conference with the teacher in small groups and explain GMO food and describe the benefits and drawbacks of using GMO foods (formative assessment).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Why are GMOs Bad?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Newspaper Article:
*Photosynthesis on Steroids* by Seth Borenstein, 11/18/2016

YouTube Video
https://www.youtube.com/watch?v=sH4bi60alZU

Top banana

Why are GMOs Bad?
<table>
<thead>
<tr>
<th>Day(s) and Desired Outcome(s)</th>
<th>Texts and Resources</th>
<th>Instructional Notes (including Scaffolding, Extensions, Vocabulary Terms and strategies, UDL Principles, and Formative Assessments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day(s) <strong><strong>4</strong></strong>: Desired Outcome(s): Students will cite specific textual evidence.</td>
<td>iPads with internet access</td>
<td>Students will be introduced to the expectations for the summative assessment, a collection of resources and a list of topics to use for the summative assessment. The teacher will show the model product: a video about GE Mosquitoes. Students will select a real world example of genetic modification from the list provided to analyze the benefits and drawbacks of.</td>
</tr>
</tbody>
</table>

Some, randomly selected students will share their summary and analysis with the whole class (formative assessment).
Students will begin researching their example and collecting evidence from the resources. The students might need to find additional resources from the internet to find sufficient information to meet the assessment expectations (MS-LS4-5, RST.6-8.1, WHST.6-8.8).

Students will choose their “product” type (PSA, video, poster, brochure, slideshow, etc.)

As students complete the first draft of their product, they will be paired with another student who is done with a first draft to complete a peer review. Each student will review another student’s work using the GE Project Rubric and let their partner know where their product could be improved. After peer review, students will revise before submitting their final product (SL.8.4). Projects will be submitted to google classroom, so they can be graded by the teacher, and to the class Padlet wall, so they can be viewed by other classmates. Padlet is a website that allows anyone with the link or code to post different file types to the same page. Then, all the projects can be viewed by many different people from the same webpage.

Students will look at and take notes on at least six other student’s projects using the GE Presentation Note-catcher (MS-LS4-5, RST.6-8.1, WHST.6-8.8).

<table>
<thead>
<tr>
<th>Guidelines (Appendix 1)</th>
<th>Students will begin researching their example and collecting evidence from the resources. The students might need to find additional resources from the internet to find sufficient information to meet the assessment expectations (MS-LS4-5, RST.6-8.1, WHST.6-8.8).</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE Project Topics and Resources (Appendix 11)</td>
<td>Students will choose their “product” type (PSA, video, poster, brochure, slideshow, etc.)</td>
</tr>
<tr>
<td>Genetic Engineering Project Note-catcher (Appendix 8)</td>
<td>As students complete the first draft of their product, they will be paired with another student who is done with a first draft to complete a peer review. Each student will review another student’s work using the GE Project Rubric and let their partner know where their product could be improved. After peer review, students will revise before submitting their final product (SL.8.4). Projects will be submitted to google classroom, so they can be graded by the teacher, and to the class Padlet wall, so they can be viewed by other classmates. Padlet is a website that allows anyone with the link or code to post different file types to the same page. Then, all the projects can be viewed by many different people from the same webpage.</td>
</tr>
<tr>
<td>GE Project Rubric (Appendix 2)</td>
<td>Students will look at and take notes on at least six other student’s projects using the GE Presentation Note-catcher (MS-LS4-5, RST.6-8.1, WHST.6-8.8).</td>
</tr>
<tr>
<td>GE Mosquitoes Model Video (Appendix 9)</td>
<td></td>
</tr>
<tr>
<td>GE Presentation Note-catcher (Appendix 10)</td>
<td></td>
</tr>
</tbody>
</table>
Major Idea/Topic #5: Answer Essential Question: To what extent and for what purpose should humans genetically modify organisms?

<table>
<thead>
<tr>
<th>Day(s) and Desired Outcome(s)</th>
<th>Texts and Resources</th>
<th>Instructional Notes (including Scaffolding, Extensions, Vocabulary Terms and strategies, UDL Principles, and Formative Assessments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day(s) <em><strong>1</strong></em>_:</td>
<td>GE Presentation Note-catcher (Appendix 10)</td>
<td>Students will write an answer to the essential question that is based on all the information they have learned about genetic modification. They will cite evidence from the other student presentations shared on the class padlet wall (MS-LS4-5, WHST.6-8.8).</td>
</tr>
</tbody>
</table>

Other (important elements not captured in this template, explanation, reflection supplementary materials):

**Appendix 1**

**Genetic Engineering Project**

**Purpose**
1. To research how humans influence the inheritance of desired traits in organisms
2. To explain the benefits and drawbacks of human influence on the desired traits in an organism
3. To gather relevant, credible and accurate information from multiple sources
4. To cite specific textual evidence to support your analysis of genetic engineering

**Directions:** Choose a real world example of genetic engineering to research and create a “product” about. Possible products include: video, presentation, slideshow, poster, PSA, brochure, paper and almost anything else you can think of. Check with me if you have questions about what to do! Your product should include the following:
1. Summarize your chosen example of genetic engineering
   ● How have humans influenced the genetics in your example?
   ● Why are humans influencing the genetics in this way? What is the purpose?
2. What are the benefits of this type of genetic engineering?
   ● What is good about this type of genetic engineering?
   ● How does this type of genetic engineering help the planet and/or humanity?
3. What are the drawbacks of this type of genetic engineering?
   ● What is bad about this type of genetic engineering?
   ● How is this type of genetic engineering harmful to the planet and/or humanity?

Must include at least: 5 pictures, 3 sources, 2 statistics, and (at least!) 1 piece of textual evidence from each source

Projected timeline:
● Day 1:
  ○ Find a real world example of genetic engineering to research (10 minutes)
  ○ Start researching and taking notes on your note-catcher
● Day 2:
  ○ Finish all research
  ○ Find all photos, video clips and infographics to use when making your product
  ○ Choose what type of product you will make and start working on it!
● Day 3-4:
  ○ Finish making your product
  ○ When you’re done, let me know and I will pair you with someone for peer review using the GE Project Rubric (Be kind and do your best!!)
  ○ Make any changes/improvements based on the suggestions from your peer reviewer
  ○ Upload to Google Classroom and the class padlet wall
● Day 5:
  ○ Look at the projects posted on the class padlet wall
  ○ Take notes on at least six other student’s projects using the GE Presentations Note-catcher
  ○ Use your notes from the presentations to answer the essential question at the end of the Presentation Note-catcher.
### Appendix 2
Genetic Engineering Project Rubric

<table>
<thead>
<tr>
<th>Criteria</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>How have humans influenced the inheritance of the desired traits in your chosen organism?</td>
<td>The project <strong>explains</strong> how humans have influenced the traits of an organism with <strong>great</strong> detail and clarity</td>
<td>The project <strong>explains</strong> how humans have influenced the traits of an organism with <strong>moderate</strong> detail and clarity</td>
<td>The project <strong>mentions</strong> how humans have influenced the traits of an organism <strong>without</strong> detail or clarity</td>
<td>The project <strong>briefly mentions</strong> that humans have influenced the traits of an organism <strong>without</strong> detail or clarity</td>
<td>Not Present</td>
</tr>
<tr>
<td>What are the benefits and drawbacks of human influence on the desired traits in your chosen organism?</td>
<td>The project <strong>explains</strong> the benefits and drawbacks of human influence on the desired traits of an organism with <strong>great</strong> detail and clarity</td>
<td>The project <strong>explains</strong> the benefits and drawbacks of human influence on the desired traits of an organism with <strong>moderate</strong> detail and clarity</td>
<td>The project <strong>mentions</strong> the benefits and/or drawbacks of human influence on the desired traits of an organism <strong>without</strong> detail and clarity</td>
<td>The project <strong>briefly mentions</strong> the benefits and/or drawbacks of human influence on the desired traits of an organism <strong>without</strong> detail and clarity</td>
<td>Not Present</td>
</tr>
<tr>
<td>Is your information from multiple relevant, credible and accurate sources?</td>
<td>The project includes information from <strong>multiple</strong> relevant, credible and accurate sources</td>
<td>The project includes information from <strong>some</strong> relevant, credible and accurate sources</td>
<td>The project includes information from sources and <strong>some</strong> are relevant, credible and/or accurate</td>
<td>The project includes information from sources that are <strong>not</strong> relevant, credible or accurate</td>
<td>Not Present</td>
</tr>
<tr>
<td>Did you cite specific text evidence to support your analysis of genetic engineering?</td>
<td>The project cites <strong>several</strong> pieces of specific text evidence to <strong>support</strong> the analysis</td>
<td>The project cites specific text evidence to <strong>support</strong> the analysis</td>
<td>The project cites text evidence but it <strong>does not support</strong> the analysis</td>
<td>The project does not cite text evidence and/or the evidence <strong>does not support</strong> the analysis</td>
<td>Not Present</td>
</tr>
</tbody>
</table>

Appendix 3

Original unit development sponsored by The Idaho Coaching Network
Name: __________________________________________
Date: __________________________ Period: __________

Cloning
Directions: Use the CK-12 iBook to learn more about cloning. Answer the following questions in your own words.

1. What is a clone and how can they be created?

Gene Therapy
1. What is gene therapy? What are benefits to gene therapy? What are drawbacks to gene therapy?

Biotechnology in Agriculture
1. What does it mean if a crop is transgenic and why are transgenic crops being created?

Appendix 4

Genetic Engineering Vocab

Targeted Vocabulary: engineer, manipulate, GMO, CRISPR, inherited, trait
See it, Say it, Show it, Store it: Look at the written vocabulary word, then we will say it slowly together, then you will write the word and a definition in your own words.

1. 
2. 
3. 
4. 
5. 
6. 

Concept Map: Create a concept map to show how the 6 vocabulary words are related to each other.
Appendix 5

Issue Overview: Gene editing

Bloomberg, adapted by Newsela staff

Grade Level 7 Word Count 653

Mankind has been manipulating genetics for thousands of years. Long ago, early civilizations realized that certain traits of crops, animals and humans were hereditary. The modern-day mapping of all human genes raised the possibility of learning precisely which genes control which traits and then directly altering their DNA codes. For years, those tasks were both challenging and hit-and-miss. But a new technology on every geneticist's tongue is
Crispr-Cas9, more commonly called Crispr, is a gene-editing system. It is so simple, cheap and effective that it promises to change mankind's relationship with genetics. Champions of Crispr believe it could help control pests, increase food production and eliminate human diseases. Others worry that it could be used to create designer babies, dangerous mutants and biological weapons.

The Situation

Labs and companies in at least 83 countries are experimenting with Crispr. They hope to kill off malaria-carrying mosquitoes, make wheat resistant to mildew and produce eggs suitable for people allergic to them. A group of scientists at Harvard is even trying to bring a woolly mammoth back from extinction.

The most attention-grabbing experiments relate to human disease. In experiments with human cells, researchers have used Crispr to repair a mutation that causes blindness and to remove HIV from immune cells. In late 2015, researchers published results on the first successful use of the method to treat mature animals. They used Crispr to repair a gene in mice with muscular dystrophy. Once they did, the muscles in the animals' bodies became stronger. These experiments suggest that similar gene-editing cures could eventually be used to treat humans.

Controversially, some labs are using Crispr to experiment with human germ-line cells. These are cells such as sperm, eggs and zygotes, which pass genetic material to children. In 2015, a group of Chinese researchers published results of a Crispr experiment on human embryos, or fertilized eggs. Even though the scientists said the embryos could not grow into babies, the study was still controversial.
How Crispr-Cas9 Works

Until a few years ago, altering an organism’s genome was a cumbersome process, usually involving insertion of long strands of DNA or entire genes. Now scientists can cut and paste precise units of the genome.

The Background

Crispr-Cas9 is a simple immune system designed to fight off invaders. Japanese scientists first noticed it in bacteria nearly 30 years ago. It is made up of sequences of genetic code broken up by pieces of genes from past invaders. These gene pieces help bacteria identify the invaders when they appear again. This allows the Cas9 enzyme to slice through them.

For a long time, scientists did not understand how the system could chop through and replace DNA. Then, in 2012, researchers at the University of California, Berkeley published a breakthrough paper. They discovered how to make "guides" that allow Crispr to skim along DNA, targeting exactly the right spot to make a slice. Soon afterward, another group of scientists said they'd adapted Crispr for use in human cells.
Any researcher with basic skills and a few thousand dollars' worth of equipment can employ Crispr. This creates enormous space for both scientific breakthroughs and abuse. The gene-editing system isn't perfect, at least not yet. It makes unintended cuts in DNA as often as 60 percent of the time, with effects unknown.

The Argument

Decisions about whether to use Crispr to treat people who are already sick could be made through a straightforward consideration of risks and benefits, once these are better understood. The issues arising from germ-line editing, however, are philosophical as well as medical. The potential to do good is enormous: eliminating a genetic disease from a family forever. But if something goes wrong, the consequences are potentially eternal, too. They could affect future generations who had no say in the matter.

Some scientists worry that germ-line editing would invite enhancements of babies for nonmedical reasons. For example, babies could be engineered to be extremely intelligent. Philosopher Nick Bostrom and author Carl Shulman argued in a 2013 paper that this might be a good thing. They say that cognitively enhanced individuals could produce ideas and inventions that improve life for everyone.

Text Dependent Questions

1. What is different about Crispr compared to other methods of gene editing?
2. In the first paragraph in “The Situation” section, what words stand out the most? Why?
3. How are the effects of using Crispr on body cells different from the effects of using Crispr on germ line cells?
4. What does the author want you to understand after reading this article? What evidence from the text makes you think that?
<table>
<thead>
<tr>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Source (Title, Author Name, Date, Source)
From farm to lab to table, a tale of tomatoes and a top banana, Daron Taylor and Newsela,
5/25/16, Newsela

Summary
### Benefits

<table>
<thead>
<tr>
<th>Source (Title, Author Name, Date, Source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosynthesis on steroids, Seth Borenstein, 11/18/2016, Lewiston Morning Tribune</td>
</tr>
</tbody>
</table>

### Drawbacks

<table>
<thead>
<tr>
<th>Source (Title, Author Name, Date, Source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photosynthesis on steroids, Seth Borenstein, 11/18/2016, Lewiston Morning Tribune</td>
</tr>
</tbody>
</table>

### Summary
<table>
<thead>
<tr>
<th>Benefits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawbacks</td>
<td></td>
</tr>
</tbody>
</table>

**Source (Title, Author Name, Date, Source)**
Why are GMOs Bad?, SciShow, 7/10/15, YouTube

**Summary**

**Benefits**

An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

Drawbacks

Appendix 7

GE Mosquitoes Note-catcher

Source (Title, Author Name, Date, Source)
Frankenskeeters to seek mosquito brides to curb dengue disease, McClatchy Foreign Staff, adapted by Newsela staff, 10/17/13, Newsela

Summary

Benefits
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

<table>
<thead>
<tr>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Source (Title, Author Name, Date, Source)
What If We Killed All the Mosquitoes?, SciShow, 2/19/16, YouTube

Summary

Benefits

Drawbacks
<table>
<thead>
<tr>
<th>Source (Title, Author Name, Date, Source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How To Eradicate One Of Our Deadliest Enemies – Gene Drive &amp; Malaria, Kurzgesagt – In a Nutshell, 9/21/16, YouTube</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Write a paragraph that summarizes using genetically modified mosquitoes to help control diseases and describes the benefits and drawbacks of doing this. Use evidence from the resources in your answer!
<table>
<thead>
<tr>
<th>Type of GE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Source (Title, Author Name, Date, Source)</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
</tr>
<tr>
<td>Drawbacks</td>
<td></td>
</tr>
<tr>
<td>Type of GE</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Source (Title, Author Name, Date, Source)</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
</tr>
<tr>
<td>Drawbacks</td>
<td></td>
</tr>
<tr>
<td>Type of GE</td>
<td>Source (Title, Author Name, Date, Source)</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
</tr>
<tr>
<td>Drawbacks</td>
<td></td>
</tr>
</tbody>
</table>

**Appendix 9**

Original unit development sponsored by The Idaho Coaching Network
<table>
<thead>
<tr>
<th>Type of GE</th>
<th>Benefits</th>
<th>Drawbacks</th>
<th>Type of GE</th>
</tr>
</thead>
</table>

**Essential Question:** To what extent and for what purpose should we genetically engineer organisms?
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

<table>
<thead>
<tr>
<th>Type of GE</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Benefits

Drawbacks

Original unit development sponsored by The Idaho Coaching Network
## Genetic Engineering...should we?

<table>
<thead>
<tr>
<th>Type of GE</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of GE</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawbacks</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of GE</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Benefits</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
<th></th>
</tr>
</thead>
</table>
Write a paragraph that answers the essential question. Be sure to include evidence from at least 4 different presentations.

**Essential Question:** To what extent and for what purpose should we genetically engineer organisms?
Appendix 11

GE Project Topics and Resources

12 bizarre examples of genetic engineering
https://www.mnn.com/green-tech/research-innovations/photos/12-bizarre-examples-of-genetic-engineering/mad-science

GMO Foods and Pesticide Resistant Crops

- From farm to lab to table, a tale of tomatoes and a top banana
- Issue Overview: GMOs and engineered food
- https://www.youtube.com/watch?v=sH4bi60alZU Why are GMOs Bad?

GE Mosquitoes

- Frankenskeeters to seek mosquito brides to curb dengue disease
- https://www.youtube.com/watch?v=TnzcwTyr6cE How To Eradicate One Of Our Deadliest Enemies – Gene Drive & Malaria
- https://www.youtube.com/watch?v=e0NT9i4Qnak What If We Killed All the Mosquitoes?

Bringing Extinct Species Back to Life

- Passenger pigeons are extinct, but scientists hope to bring them back
- https://www.youtube.com/watch?v=y-0mT4oQH3o Resurrection Biology: How to Bring Animals Back From Extinction
### Spider Silk in Goat Milk


### GE Trees that Fight Pollution or Grow Faster

- [https://www.biofortified.org/2008/01/pollution-fighting-poplar-trees/](https://www.biofortified.org/2008/01/pollution-fighting-poplar-trees/)

### GE Salmon that Grow Faster

- [https://www.fda.gov/animalveterinary/developmentapprovalprocess/geneticengineering/geneticallyengineeredanimals/ucm280853.htm](https://www.fda.gov/animalveterinary/developmentapprovalprocess/geneticengineering/geneticallyengineeredanimals/ucm280853.htm)

### CRISPR

- [Opinion: We can – and should – engineer a better baby but set limits](https://www.mnn.com/green-tech/research-innovations/photos/12-bizarre-examples-of-genetic-engineering/super-carbon#top-desktop)
- [Gene-editing kit stirs up worry over do-it-yourself DNA creations](https://www.mnn.com/green-tech/research-innovations/photos/12-bizarre-examples-of-genetic-engineering/super-carbon#top-desktop)
- [Genome Editing with CRISPR-Cas9](https://www.mnn.com/green-tech/research-innovations/photos/12-bizarre-examples-of-genetic-engineering/super-carbon#top-desktop)
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  Unit Title: Genetic Engineering...should we?

Fast growing salmon
Glow in the dark cats
Venomous cabbage
Medicine eggs
Enviropig
Less flatulent cows
Pollution fighting plants
Super carbon capturing plants

Original unit development sponsored by The Idaho Coaching Network
An Idaho Core Teacher Program Unit Developed by Core Teacher Name: Soona Schmidt  
Unit Title: Genetic Engineering...should we?